

Towards Establishing a Hierarchy in the Japanese Sentence Structure *

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Abstract. The Minami Hierarchy or the four-layers of embeddings within Japanese sentences has been known to give a convincing account of heterogeneous linguistic data in Japanese Grammar. However, the categorization of sentence constituents has faced serious problems. In this paper, we illustrate that the hierarchical sentential structure is on the whole tenable and attempt to represent it with Phrase Structure Grammar rules. The result is a realization of surface syntactic structure information that can serve as input to Scope Control Theory, a routine of interpretation or semantic evaluation that requires the generalizations of Minami's hypothesis to hold true for evaluation to successfully complete.

Keywords: hierarchy, Japanese, sentence structure, surface syntax, semantic evaluation

1 Introduction

The purpose of this paper is to argue that the hierarchical theory of Japanese sentence structure, against which a set of linguistic data have been provided as counterevidence, is on the whole tenable. The result is presented in the form of Phrase Structure Grammar rules. By this we show that the hierarchical view of sentence structure in the traditional Japanese grammatical studies can be developed into a semantics-based sentence processing system with multiple layers of localities in which scopes are manipulated and constraints enforced that guarantee sentence integrity.

2 Minami's Hypothesis

Minami (1964, 1974) found that cooccurrence of sentence constituents within subordinate clauses is restricted by the type of the subordinate clause head, i.e., the conjunctive particle that introduces the subordinate clause. In (1), while the accusative case NP *shinbun o* is included in the subordinate clause indicated by the brackets, the nominative case NP *Tarō ga* is not. This is evidenced by the fact that two separate subjects both for the matrix and subordinate clauses are not allowed in such complex sentences. A topic phrase marked by *wa* also cannot appear within this type of subordinate clause.

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- (1) Tarō ga [shinbun o yomi] nagara gohan o tabe-te iru.
 NAME NOM newspaper ACC read SIML meal ACC eat PROG
 ‘Taro is eating reading the newspaper.’

Furthermore, while a certain group of auxiliaries (e.g., the causative and passive auxiliaries (*sa*)*seru* and (*ra*)*reru*) and adverbials may occur within the subordinate clause headed by *nagara*, others (e.g., the negative *nai*, past *ta*, politeness *masu*, and epistemic/voluntative *o* and *darō*) may not.

A subject NP can be contained within another group of subordinate clauses. In (2), a subject NP *Tarō ga* occurs in the subordinate clause marked by *to* (CONDITIONAL).

- (2) [Tarō ga gitā o hiku] to Haruko ga utat-ta.
 NAME NOM guitar ACC play SUCC NAME NOM sing PST
 ‘After Taro had played the guitar, Haruko sang.’

This kind of subordinate clause head cooccurs not only with those constituents that can appear within the *nagara* subordinate clause, but also with others that cannot—for example, the auxiliaries of past tense *ta*, negative *nai*, politeness *masu*. However, a topicalized NP cannot occur.

There exists still another group of subordinate clauses, for instance, those marked by *ga*, which allow the topicalized NP marked by *wa*, the epistemic auxiliary verb *darō*, and other constituents that do not cooccur within the two types of subordinate clause explained above.

- (3) [Haruko wa Supein e iku darō] ga Akiko wa Itaria e iku darō.
 NAME TOP Spain GOAL go EPIST ADVS NAME TOP Italy GOAL go EPIST
 ‘Although Haruko will go to Spain, Akiko will go to Italy.’

On the basis of this observation, Minami (1974) proposed a classification of subordinate clauses with three categories A, B, and C, being inner to outer in this order, where constituents in an inner subordinate clause may constitute an outer subordinate clause, but not vice versa. It has been known among the researchers of Japanese linguistics that linguistic data ranging over subject/topic coreference, tense, and scope of question and negation in complex sentences relate essentially to Minami’s hierarchical sentence structure (see Kuno 1973 and Takubo 1987).

Furthermore, Minami (1974) extends his idea to the general structure of the Japanese sentence. The whole sentence is analyzed into four layers, A, B, C, and D, with D being the outermost level corresponding to a complete utterance. A subordinate clause of a certain level itself belongs to the same level. This accounts for the fact that subordinate clauses of the same level can be recursively embedded.

3 Problems with Minami’s Theory

It has been pointed out that some linguistic data do not square with the hierarchical structure proposed by Minami.

(i) Linguistic forms assigned to more than one level

Minami assigns the subordinate clause head *te* to all of the three levels. The same form stands for the simultaneous usage at Level A, the successive and causal ones at Level B, and the independent clausal one at Level C. Likewise, the negative auxiliary verb *nai* may occur both at Levels A and B (see Onoe 1999a).

(ii) Inconsistency between classification criteria

The distinction between Levels B and C may be drawn drastically differently, depending on which of the three following classification criteria may be adopted (Onoe 1999a).

- α . Possibility of mutual inclusion by subordinate clauses;
- β . Cooccurrence between the subordinate clause and clause constituents other than the predicate, such as case NPs, topic NPs, and adverbials; and
- γ . Cooccurrence between the subordinate clauses and predicate constituents.

In particular, observation of α reveals a remarkable irregularity:

- (4) [[Yokujitsu no shiken wa sarani muzukashii darō] *kara* isshōkenmei
 the following day ADN exam TOP still more be difficult EPIST CAUSL hard
 benkyōshi-te iru] *to*, denwa ga nat- ta.
 study PROG SUCC telephone SBJ ring PST
 ‘While he/she was studying hard, since the exam given on the following day would be harder, he/she had a call.’

The sentence above gives strong evidence against the Minami hierarchy, since the subordinate clause headed by *kara* is embedded in the clause introduced by *to*, while the former is assigned to Level C and the latter to Level B by Minami (1974).

Furthermore, according to Onoe (1999b), criterion α leads to the classification (5a) below, where he distinguishes the hypothetical usage of the conditional conjunctive particles *tara* and *to* from the factual one. Here, the factual subordinate clause head *tara* and *to* belong to a level embedding that for the hypothetical subordinate clause head. This stands in a sharp contrast with (5b) resulting from the application of criterion γ .

- (5) a. α 2 Type: *ba*, *tara* (hypothetical), *to* (hypothetical)
 α 3 Type: *tara* (factual), *to* (factual)
 b. γ 3 Type: *tara* (factual), *to* (factual)
 γ 4 Type: *ba*, *tara* (hypothetical), *to* (hypothetical)

The hypothetical conjunctive particles *tara* and *to* are assigned to a level higher than that of the factual ones here, since the former can embed the evidential auxiliary verbs *yōda* and *sōda* that are illicit with the latter ones.

It has often been pointed out that, irrespective of the criterion adopted, the distinction between Levels B and C is vague, whereas those between A and B and between C and D are relatively stable. Some subordinate clause heads, typically the causal postposition *node*, are assigned to levels differing with researchers (Minami 1974 and Onoe 1999a).

(iii) Relative and quotative clauses

Relative and quotative clauses seem to offer counter-evidence against the stepwise, hierarchy-based formation of sentences, since they can embed Level B or C clauses, while they themselves play the role of a Level A constituent within the matrix clause.

4 Solutions

In this section, we show that the difficulties that have been pointed out about the Minami Hierarchy can be resolved by observing the data more closely and by introducing a new theoretical perspective.

(i) Constituents as logical operators

We suppose that the hierarchy observed in the Japanese sentence derives from the process of its evaluation. This point of view sheds a new light on why some words do not follow the hierarchical order—words indicating logical operators, e.g. those for conjunction, disjunction, negation, and

implication, may occur at different places in the hierarchy, just as logical operators may appear at various positions in the logical formula. Thus, the behavior of the conjunctive particle *te* is explained as that of conjunction. The same holds for the negative auxiliary verb *nai*.

(ii) Different classification criteria

What Onoe (1999b) points out is true in that, if the meaning of a sentence is built up step by step, the operator for factuality should outscope that part of the sentence which remains indeterminate in terms of factuality. While this is in fact reflected by the classification based on criterion α , quite the contrary is true of criterion γ , as Onoe (1999b) argues.

However, Onoe's grouping relies on the possibility of embedding the evidential auxiliary verbs *yōda* and *sōda*. As explained in the previous section, the ' γ 4 Type' subordinate clause heads, *ba*, *tara* (hypothetical), and *to* (hypothetical) are considered to be hierarchically higher than those of the ' γ 3 Type' ones, *tara* (factual) and *to* (factual), since the first group can cooccur with predicates marked by *yōda* or *sōda*, while the latter cannot.

First of all, it is evidently owing to a semantic restriction that *yōda* and *sōda* cannot be followed by the factual particle *tara* and *to*—the evidential meaning of the auxiliary verb is contradictory to commitment to actuality. Furthermore, *yōda* and *sōda*, along with the other evidential auxiliary verbs *mitaida* and *rashii*, are exceptional ones both before and after which the past auxiliary verb *ta* may appear:

- (6) Tarō ga kaet-te kuru-/ki- ta- yōda/yōdat- ta.
 NAME SBJ return come/come- PST EVID/EVID- PST
 'It seems that Taro will come/has come home.' or 'It seemed that Taro would come/had come home.'

These auxiliary verbs, in parallel with the verb *believe* that likewise introduces intensional contexts, reset their position in the hierarchical order. We consider that the hypothetical subordinate clause heads *tara* and *to* embed a factual clause, but the whole clause is reset to the position of indeterminateness. The complication of the relevant rules needed will turn out to be compatible with both criteria α and γ in (5).

Criterion α provides counterevidence against the Minami Hierarchy only in case a factual conditional clause marked by *tara* and *to* embeds a causal/adversative clause marked by *node*, *noni*, or *kara*, at least in the written style (see example (4)). We may be able to ensure compatibility between the theory and the data by more closely investigating the broad usage, which derives from its property as a logical operator, represented by the conditional particles *tara* and *to*.

(iii) Resetting the hierarchy

The difficulty with relative and quotative clauses and ones embedded by evidential auxiliary verbs is solved by introducing the concept of 'reset'. The whole constituent made up of the embedded clause and the head is itself embedded at a lower position in the hierarchy than the embedded clause. This re-introduction of the hierarchy is formalized in SCT as re-use of grammatical resources.

5 Scope Control Theory

The arguments in favor of the Minami Hierarchy developed above are essential for our theory, since they will pave the way for understanding sentence formation in Japanese from a semantic point of view. In our standpoint, the hierarchy is a reflection of multiple embeddings of semantic 'Operator-Scope' relationships. After clearing away major obstacles, we can formalize our idea with Scope Control Theory or SCT (Butler 2007).

SCT is a small logical language that attempts to approximate the dependency structures in natural language by constraining management of scopes. It stems from the sequence semantics of Vermeulen (1993) and the static setup of Dynamic Semantics by Dekker (2002) and Cresswell (2002). The theory tries to explain what is accepted as grammatically correct and what is not on the basis of formal semantics: a sentence is grammatically valid if and only if it can successfully pass through the process of interpretation or semantic evaluation. It has been proven that SCT can give a unified account of various types of linguistic data from unrelated languages, e.g., English, French, Japanese, and *Tukang Besi* (Indonesia).

We have found the structural generalizations that emerge with interactions of scopes to be almost identical to those provided by Minami (1964, 1974). Minami's classification of grammatical words in Japanese coincides with the stepwise manipulation of scopes by SCT. It has not been known why the seemingly unrelated grammatical forms, for instance, tense, subject/topic coreference, and focus of question and negation in complex sentences, behave alike in terms of the Minami Hierarchy. It has been shown that both tense and subject/topic are semantically processed through two stages, a local one limited to a clause and a global one linked to the context, and by this have given a uniform account of the similarity (Butler, Nakamura and Yoshimoto forthcoming). We show that all the grammatical morphemes in Japanese square with Minami's classification with some modifications and as such can be processed within the framework of SCT.

6 The Minami Hierarchy as PSG Rules

6.1 Outline

In this section, we illustrate, based on the solutions to the difficulties proposed in Section 4, that the relationships between the constituents in the Japanese sentence can be represented as PSG rules. While the formalization with PSG is not essential, by this we show that Japanese sentences can be perfectly processed within the semantic framework with multiply embedded Operator-Scope relationships.

Table 1 summarizes the hierarchical structure we posit for Japanese sentences. Non-predicative constituents such as case-marked NPs, adverbials, and a topic on the one hand and predicate constituents, i.e., a main verb, auxiliary verbs, conjugational endings with modal meanings, and modal particles (or 'sentence-final particles') on the other, are shown as two independent classes, since the relationship between them is too complicated to deal with together. The auxiliary verbs for politeness (*masu*) and for negation (*nai*) and adverbials agreeing with the negative auxiliary verb (e.g., *zenzen* and *kesshite*) are not included in the table owing to their irregular behaviors in terms of the hierarchy. In the table, the parentheses '{ }' indicate that there is no order specified between their elements. Likewise, the divided rows within the same columns (i.e., the same levels) have no order priority.

6.2 Predicate constituents

Level B predicate constituents are divided into three groups: (1) a boulomaic auxiliary verb that can be followed by tense and evidential auxiliaries, (2) a deontic auxiliary possibly with a tense marker, and (3) no modality marking. This is to meet complicated cooccurrence restrictions observed by Narrog (2009), which undergo a more limited interpretation here than he considers. (1) and (2) can be further suffixed by the epistemic auxiliary *darō* at Level C. (3) is followed by the distinct classes of constituents at Levels C and D. The first may cooccur with the volitive auxiliary (*yo*)*o* at Level C, while the second can be marked by the imperative conjugational ending at Level D.

We have posited a consistent set of PSG rules that represent the hierarchical relationships between sentence constituents outlined in Table 1. Below we give some explanations about it, limiting ourselves to most crucial issues.

Table 1: Scope relationships between sentence constituents

	A	B	C	D
Predicate constituents	main verb < causative < {passive, potential} < donative < honorific	boulomaic < evidential ₁ < tense ₁ < evidential ₂ < tense ₂ < deontic < tense	< epistemic < volitive	< modal particle < imperative
Non-predicative constituents	non-subject NP < state adverbial < degree adverbial < adv postposition ₁	subject NP < place adverbial < time adverbial < adv postposition ₂	topic < evidential adverbial < evaluative adverbial	< illocutionary adverbial < {response, addressive}

NOTES. causative: (sa)seru; passive: (ra)reru; potential: eru, rareru, dekiru; donative; -te kureru, -te yaru, -te morau; boulomaic: tai, -te hoshii; evidential₁: sōda₁; tense_{1,2}: ta; evidential₂: yōda, mitaida, sōda₂, rashii; deontic: bekida; epistemic: darō; volitive: (yo)o; imperative: the verbal conjugational ending for imperative; modal particle: ‘sentence-final particles’ yo, ne, etc.; adverbial postposition₁: a phrase suffixed by dake or made; adverbial postposition₂: a phrase suffixed by wa (contrastive), mo, or sae; topic: a phrase suffixed by wa (topic); response: hai, iie, etc.

Negative auxiliary *nai*

As explained above, the distribution of the negative auxiliary verb *nai* cannot be specified at a single point in the sentential hierarchy. Once the hierarchy has been established, however, its behavior can be constrained by assigning its position to multiple locations in the hierarchy:

- (i) between passive/potential and donative auxiliary verbs,
- (ii) immediately before a Level A clause has been completed, and
- (iii) immediately after a tense marker has been suffixed, both before and after an evidential auxiliary verb (the relative order between the tense and the negation may not directly reflect their scoping relationships).

Politeness auxiliary *masu*

The auxiliary verb for politeness *masu* causes further complexities. On one hand, the order between the politeness, negation, and tense markers is rather complicated. On the other hand, the contribution of *masu* to the sentence meaning is pragmatic in distinction from most of the other predicate constituents. For this reason, repetition of the *masu* form is possible in colloquial speech. The distribution of the politeness auxiliary verb can be specified based on the proposed hierarchy. Roughly, it occurs immediately before a tense marker in (1) and (2) at Level B mentioned in the beginning of this subsection (therefore, it can be repeated within Level B), and is the only possible auxiliary verb in (3).

Evidential auxiliary verbs

The complexity observed about the evidential auxiliary verbs is dealt with by the following PSG rules:

- (7) 12 B_Evidential-Clause_S1 → A-Clause + Boulomaic
- 13 B_Evidential-Clause_S2 → B_Evidential-Clause_S1 + Evidential1
- 14 B_Evidential-Clause_S3 → B_Evidential-Clause_S2 + Tense1
- 15 B_Evidential-Clause_S41 → B_Evidential-Clause_S3 + Evidential2
- 16 B_Evidential-Clause_S42 → B_Evidential-Clause_S3 + Evidential3

- 17 B_Evidential-Clause_S5 \rightarrow (B_Evidential-Clause_S41 | B_Evidential-Clause_S42)
+ Tense2
- 25 B_Evidential-Clause \rightarrow Adverbial_PP2 + B_Evidential-Clause_S5

While Evidential2 (i.e., *yōda* and *mitaida*) and Evidential3 (i.e., *rashii* and *sōda*) can both follow and be followed by the tense marker, repetition of the former auxiliary verbs is forbidden. In this respect, the evidential auxiliary verbs behave differently from relative or quotative clauses that allow for multiple recursive embeddings. For this reason, recursive application of rules is abandoned here and the inner and outer tenses are dealt with by the two distinct rules 14 and 17.

6.3 Subordinate clause heads

Subordinate clause heads are classified as follows, depending on what kind of sentence constituent they embed. It is based on both the authors' intuition and the corpus study by Narrog (2009).

Level A

*Nagara*₁ (simultaneity), *tsutsu* (simultaneity), *te*₁ (state adverbial), a reduplicated verb with the 'renyōkei' form, and an adjective with the 'renyōkei' form belong to this level. A single PSG rule is imposed to deal with all of them:

- (8) 10 A_Sub-Clause \rightarrow A-Clause + A_Sub-Clause_H1

Level B

To includes *sōda*₁ and does not include a boulomaic or tense auxiliary (we need some more constraints for 30 in (9) below). *Ba* includes a boulomaic, but not a deontic. *Tara* includes a boulomaic and evidential auxiliaries *sōda*₁ and *yōda*, excluding a deontic. *Nara* includes the evidential auxiliary *yōda*, a deontic, and tense. *Node* includes evidential, deontic, and tense auxiliaries, but without the epistemic auxiliary *darō*. It includes a topic.

- (9) 30 B_Sub-Clause1 \rightarrow B_Evidential-Clause_S2 + B_Sub-Clause_H1 % *to*
 31 B_Sub-Clause2 \rightarrow B_Evidential-Clause_S1 + B_Sub-Clause_H2 % *ba*
 32 B_Sub-Clause3 \rightarrow B_Evidential-Clause_S41 + B_Sub-Clause_H3 % *tara*
 33 B_Sub-Clause4 \rightarrow (B_Evidential-Clause_S41 | B_Deontic-Clause) +
 B_Sub-Clause_H4 % *nara*
 34 B_Sub-Clause5 \rightarrow C_Epistemic-Clause + B_Sub-Clause_H5 % *node*

If the hypothetical and factual usages of the conditional clause are to be distinguished (Onoe 1999b), 32 above is for the hypothetical one. The factual usage is given by the following rule:

- (9') 32' B_Sub-Clause3' \rightarrow B_Evidential-Clause_S2 + B_Sub-Clause_H3'

While the clause embedded by B_Sub-Clause3, i.e., B_Evidential-Clause_S41 in Rule 32, is hierarchically higher and embeds the clause B_Evidential-Clause_S2 embedded by B_Sub-Clause3' (see 14 and 15 in (7)), the relationship between the subordinate clauses themselves are reversed. In the hierarchy, B_Sub-Clause3 is dealt with as an adverbial phrase lower in the hierarchy than B_Sub-Clause3'. By this 'resetting', the contradiction pointed out in Section 3 is resolved.

The PSG rules posited above show that Level B subordinate clauses are heterogeneous and undergo a gradual transition to Level C. This is in accord with what has been repeatedly pointed out by traditional Japanese grammarians. In particular, the *node* clause stands on the border and may be regarded as belonging to Level C, if the inclusion of topic (this is specified by 'C_Epistemic-Clause') is emphasized rather than the absence of *darō*.

Level C

Noni is classified here, since it includes *darō*. But it does not include (yo)o. *Temo/to(mo)*, *kara*, *keredo*, *ga*, and *shi* may contain all the Level C constituents.

- (10) 42 C_Sub-Clause1 \rightarrow C_Epistemic-Clause + C_Sub-Clause_H1 % *noni*
 43 C_Sub-Clause2 \rightarrow C-Clause + C_Sub-Clause_H2 % *kara, keredo*, etc.

Like the Level A subordinate clauses, the Level C ones behave quite uniformly except *noni*, in contrast with the Level B clauses.

7 Conclusion

In this paper, we have explained that the criticisms against Minami's (1964, 1974) hierarchical sentence structure in Japanese can be rebutted and his basic idea can be formalized as PSG rules. While Minami's strict four level categorization of sentence constituents does not exist any longer, his view has been maintained according to which each word in the sentence contributes consecutively to the formation of sentence meaning. Our result can be applied to two purposes. First, it can be used to provide constituent structure information which, when combined with word token and word class information, will provide sufficiently rich information to serve as input to the routine of interpretation or semantic evaluation of SCT, with successful evaluation leading to the production of predicate language-like representations of sentence meaning. Furthermore, success or failure of the SCT evaluation can be used as a basis for determining grammaticality as well as providing traceback information to facilitate efficient parsing.

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